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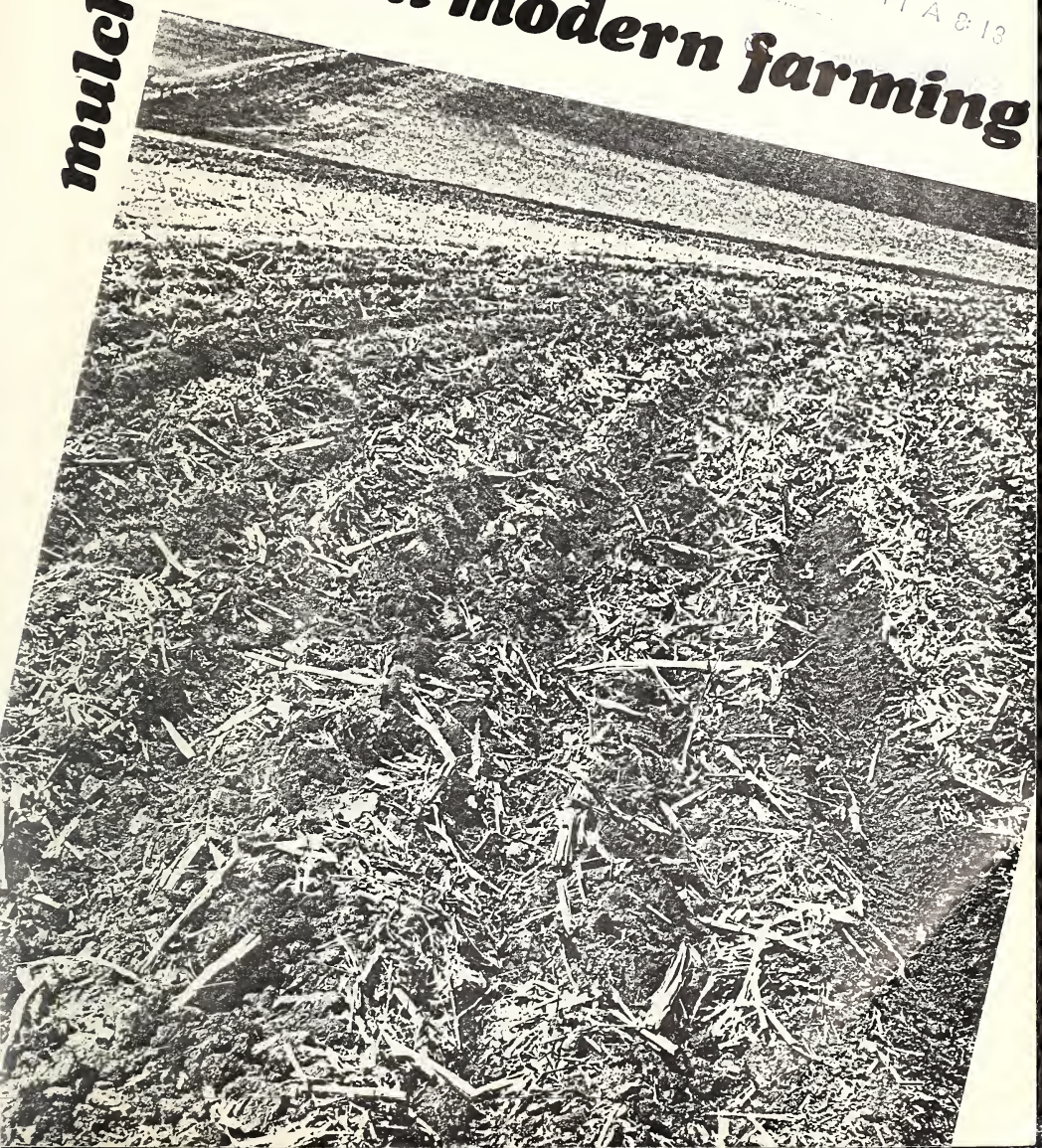

mulch tillage in modern farming

by William A. Hayes, *conservation agronomist,* Soil Conservation Service

Mulch tillage is a system of managing the soil for row crop production. It includes leaving residues from the previous crop on or just beneath the soil surface throughout the cropping year. Some mulch tillage methods used by farmers today are called no tillage or zero tillage, slot planting, chisel planting, till planting, and strip tillage.

Advantages and disadvantages of mulch tillage

Advantages
- Requires less labor
- Lowers production costs
- Conserves moisture
- May improve yields
- Makes double cropping easier
- Reduces erosion
- Furnishes food and cover for wildlife

Disadvantages
- Lowers soil temperatures
- May increase pest problems

Advantages

Modern mulch tillage machines can prepare a seedbed, apply fertilizer, plant the crop seed, and apply herbicides all in one operation. Even though this can be done, not all farmers choose to complete all jobs in the one operation. It costs about $1 a mile to pull a tillage implement with a tractor, so it pays to hold trips across a field to the minimum. Since most tillage operations are done at 4 miles an hour, each hour of tillage eliminated saves $4. Many farmers report that changing from conventional tillage to mulch tillage saves $8 to $14 an acre.

Researchers have found that soils in mulch-tilled corn plots are higher in moisture than those in conventionally tilled plots during the corn growing season. Many farmers report that mulch-tilled fields generally do not show moisture stress as soon as conventionally tilled fields during dry periods. Both researchers and farmers report that on well-drained soils, yields for mulch-tilled corn are equal to or higher than those for con-

Severe erosion has occurred on this field where corn was removed for silage. Where the corn was harvested for grain and the corn residue was left on the surface over winter, there is little erosion.

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Soybeans planted in small grain stubble. The stubble helps prevent lodging of beans and provides excellent erosion control.

ventionally tilled corn. The greatest difference in yields is usually in dry years. On heavy (fine-textured) soils mulch tillage often results in lower corn yields.

Mulch tillage works well with double-cropping systems in which either corn or soybeans follows small grain. Since either crop can be planted immediately after the grain is combined, farmers in the South can take full advantage of the long growing season.

Both farmers and research workers report that mulch tillage is an excellent practice for controlling water erosion. At Madison, Wis., on Miami silt loam, 6 percent slope, erosion was reduced 77 percent on third-year corn. Only 45 percent of the surface was covered by shredded cornstalks and the corn was planted up and down slope. At Coshocton, Ohio, on Muskingum silt loam, 9 to 15 percent slopes, planting corn on the contour and conventional tillage resulted in a soil loss of 7.8 tons an acre; the mulch-tilled plots lost only 0.03 of a ton. In Indiana on Russell silt loam, 5 percent slope, a chopped-hay mulch on a minimum-tilled surface reduced soil loss by 95 percent. The more complete the mulch cover, the greater the reduction in erosion, runoff, and moisture evaporation.

If strip tillage, chisel planting, and till planting equipment is used on sloping land, it is best to plant on the contour. If planting is done up and down slope with this type of equipment, there is considerable danger of concentrating water in the tilled area, which can result in serious erosion. If planting must be done up and down slope, use slot planting, no tillage, or zero tillage equipment. The area tilled is smaller, which reduces the chance of concentrating water on freshly tilled soil.

Corn, soybean, and small grain residues left on the soil surface throughout the year are effective in controlling wind erosion. For over-winter protection, do not chop cornstalks until just before planting time. Land covered with soybean or small grain residue "as left by the combine" is ready for planting the new crop except for applying lime or fertilizer, or both. Some highly erodible soils may require additional wind erosion control measures such as wind barriers, cover crops, or other special treatment.

Soil blowing has increased in humid areas of the United States with the growing of more corn and soybeans on larger fields. Some farmers have suffered great financial loss. Recently a newly constructed $5,000 drainage ditch on a farm in Illinois was filled with soil blown from an adjacent fall-plowed field. State and county highway departments also are faced with expensive

IA-2814

Soil blown from a fall-plowed field has plugged the culverts in this road ditch.

ditch cleaning because of windblown soil. Loss of drainage outlets, whether public or private, often results in crop loss and increased maintenance costs to farmers.

Crop residues are especially helpful to wildlife during the critical winter months. Pheasants, quail, and rabbits are often scarce on farms where crop residues are plowed under in the fall.

Disadvantages

Seed germination and seedling growth are slower on mulch-tilled fields than on conventionally tilled fields because the soil warms up later in the spring. But on well-drained soils the moisture conserved by the mulch apparently helps offset this delay later in the growing season.

Some farmers report increased damage to corn from mice, slugs, and birds in mulch-tilled fields. Because the residues change the microenvironment, such problems and others may show up. They need not cause undue alarm, but they emphasize the need for continued study and teamwork by agricultural scientists.

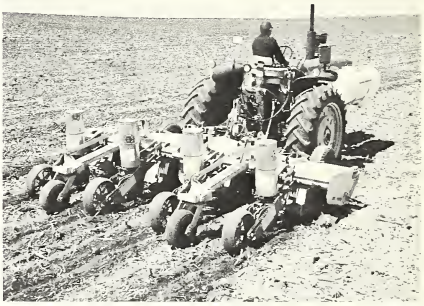
Factors to consider in buying equipment

No piece of equipment is best suited for all conditions. A farmer should evaluate all the mulch tillage equipment available for producing his crop, such as corn, sorghum, and soybeans, in his climatic area, on his soils, and with his available labor, power, and the like.

All mulch tillage units on the market till and plant in the residues of corn, soybeans, and small grain, but some units operate better than others in sod. Farmers who are trying for optimum yields in the extreme northern part of the corn-growing area should usually avoid planting corn or beans in sod. The soil under sod usually has a lower temperature than that under grain crop residues, and germination and seedling growth are delayed. Planting in sod seems to be all right in areas farther south (southern Illinois and the South) where the soil warms a little earlier and the growing season is longer.

Usually it is best to use rotary-type equipment only on sandy and sandy loam soils. It is difficult to operate on stony land. Mounting of individual tillage and planting units of all types of equipment must be flexible enough to permit riding over stones without stopping or lifting the adjoining units from the ground.

Slot planting is not well suited to clay soils because the slot has a tendency to open when the soil dries. If the soil is dry, it is difficult to close the slot with press wheels and to get good contact between seed and soil.



IA-2810

In strip tillage a strip no wider than one-third of the distance between rows is disturbed.

You need to take into account whether your land is rough, irregular, or terraced. If the equipment you plan to buy is four-row or more, each unit should be on a flexible mount so that each unit moves up and down individually. Flexible mounting is not so important for two-row units.

Chisel and rotary tillage and planting units usually require more power than other types. The size of the planter is another factor that determines how much power is needed.

Amount of residue needed to control erosion

In fields planted by no tillage, zero tillage, or slot planting methods and with 6,000 pounds an acre of corn residue on the soil surface, water erosion is 90 percent less than that in fields of conventionally planted corn. Strip tillage, till planting, or chisel planting with 6,000 pounds of corn residue on the surface reduces erosion by about 70 percent. More than 6,000 pounds an acre does not greatly increase the effectiveness the mulch in controlling water erosion. Less than 6,000 pounds of residues an acre reduces the effectiveness of mulch tillage as an erosion control practice; yet as little as 3,000 pounds is still effective. Pound for pound, small grain and soybean residues are twice as effective as corn residue. Sod residue is a little more than twice as effective as corn or sorghum residue.

IA-2812

This no-till planter disturbs the soil only in the immediate area of the crop row.

Large quantities of crop residues on the soil surface usually require some modification of weed-control programs. Many farmers using mulch tillage rely entirely on chemicals for weed control and for killing or suppressing sod residues. Others find it necessary to use both chemicals and mechanical cultivation. Regardless of the means used, it is essential to have good weed control. But remember that cultivation buries residues and increases erosion.

The amount of residue is also very important in designing systems to control wind erosion. The kind of residue affects the quantity needed. Whether the residues are flat on the soil surface or standing is also important. Standing residues are more effective in reducing velocity of the wind, which reduces its ability to transport soil. Other factors that influence design of a control system include climate, size of the soil particles, soil surface roughness, and width of the field.

Your local representative of the Soil Conservation Service can help you design an effective water and wind erosion control system.

Estimating amount of residues

You can estimate the quantity of crop residues by measuring sample areas or by using crop yields as a base.

To estimate from sample areas, first collect air-dry crop residues from three 1-square-yard plots selected at random. A 1-square-yard frame makes plot marking easier. Collect all residues down to the soil surface. Shake out soil and stones. Weigh all three samples and record the total weight in ounces. Multiply this weight by 100. This gives pounds of residue per acre.

In till planting, the area of the old crop row is scalped and the residue pushed aside, leaving a protective cover between rows.

IA-2800

NC-2126

A slot planter leaves crop residue on the surface. Only the soil in the slot in the crop row is disturbed.

To estimate amount of residues from crop yields, consider that for each pound of corn produced there is 1 pound of residue (100-bushel corn equals 5,600 pounds of residue). For each bushel of small grain there are 100 pounds of residue (30-bushel wheat equals 3,000 pounds of residue). Soybean residue usually ranges from 1,500 to 2,500 pounds an acre. For sod residue, estimate the quantity of hay the residue would make (3,000 pounds an acre gives optimum erosion control).

Tillage operations reduce the amount of residue left on the surface. Each time a chisel with shanks 12 inches apart is used on a field the amount of residue is reduced by 20 percent.

Another way of estimating residue quantity is to compare the amount of residue on your fields with the photographs that follow.

Here the seedbed is prepared by chiseling without turning the soil, leaving a protective cover of crop residue on the surface.

IA-2802

IA-2815

Corn residue as left by the picker—7,100 pounds an acre.

NEB-2135

Corn residue as left by the picker—6,000 pounds an acre.

Corn residue as left by the picker—5,300 pounds an acre.

IA-2813

Sorghum residue as left by the combine—2,500 pounds an acre.

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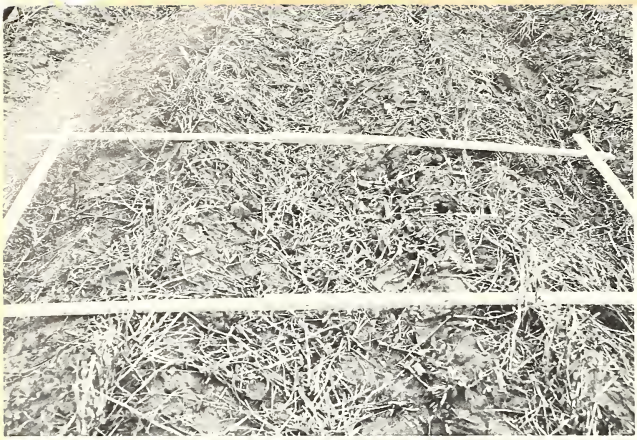

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Soybean residue as left by the combine—2,250 pounds an acre. Soybean residue usually ranges from 1,500 to 2,500 pounds an acre.

KAN-2018

Small grain residue as left by the combine—3,000 pounds or more an acre, which gives optimum erosion control. Small grain residue usually ranges from 3,000 to 4,000 pounds an acre.

MO-2035

Ky-31 tall fescue sod residue—3,000 pounds or more an acre, which provides optimum erosion control. Sod residue usually exceeds 3,000 pounds an acre.

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